



## Research Article

# STUDY OF SEASONAL CHANGES IN PLASMA GROWTH HORMONE AND CORTISOL LEVEL WITH BODY WEIGHT GAIN FEATURES IN BLACK BENGAL GOATS DURING FIRST SIX MONTH OF GROWTH PERIOD

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**Abstract-** In this present investigation, comprehensive study on the seasonal effect on hormonal parameters (Growth Hormone and Cortisol) in pre pubertal state was done in black Bengal goats reared under free range system. The parameters were studied on day 15, day 30, day 60, day 90, day 120, day 150 and day 180 after birth during summer and winter season. Kids were weaned at 2 months and reared in completely free ranged system without any concentrate. Blood samples were collected from six randomly selected male and female kids during summer and winter season for hormonal studies. The major finding of this study was that body weight is a unique parameter amongst the various growth parameters which varied between age and season. Growth hormone had highly significantly ( $P \leq 0.01$ ) positive correlation with body measurements. The mean concentration of growth hormone was found to be lower than the earlier reports ( $0.41 \pm 0.01$  ng/ml) indicating probable cause of stunted growth in highly prolific black Bengal goat. Seasonal variations in Cortisol levels significantly ( $P \leq 0.01$ ) increased during summer.

**Keywords-** Growth, Kids, Summer, Winter, Body weight

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## Introduction

As the global population is expected to increase up to 9.22 billion in 2075 [1], demand for high quality animal protein and fibre is expected to rise. It has been anticipated that over the next decade, there will be a massive increase in the demand for food of animal origin. As more than 90% of goats are kept by individual farmers in the rural areas in rural management system, alternate strategies for improvement are needed to raise the awareness and income of the farmers. Black Bengal goats has advantages reputed for their excellent meat quality, prolificacy, fertility, early sexual maturity and adaptability to hot humid conditions. But the breed shows stunted growth [2]. It is a dwarf goat, at 12 months of age live weight gain was 15 kg [3].

Hence the knowledge of probable cause of stunted growth of this excellent meat breed may help in the improvement of growth rate and help farmers in better economic return. Therefore, the present study was undertaken to assess the growth performance along with hormonal (Growth hormone and Cortisol) profile of Black Bengal kids during first six month of life under free range rearing system. The study was conducted considering season (summer and winter) to obtain complete knowledge about seasonal effect on hormonal parameter during prepubertal growth period.

## Materials and Methods

### Description of the study site and experimental goats

The study was carried out at ICAR-IVRI, ERS at Kalyani Goat Farm of Nadia district, West Bengal. The farm is located at an altitude of 11 M above the mean sea level, at latitude of  $22^{\circ}98'$  N and at longitude of  $88^{\circ}44'$  E. The place falls in lower Gangetic Plain Region of India [4]. Soil is clay loamy pattern with pH varying from 6.5 to 8.75. In this study, 25 male and 25 female kids were selected randomly from the chosen doe those were born during summer and winter season for recording of various growth parameters. Following growth parameters were recorded-Body Weight, Linear length, Height and Heart girth.

Out of these 50 kids, further, randomly 6 male kids and 6 female kids (total 12 kids) were selected for hormonal study. Samples as well as various records were collected from the kids at day 15<sup>th</sup>, 30<sup>th</sup> (1 Mo), 60<sup>th</sup> (2 Mo), 90<sup>th</sup> (3 Mo), 120<sup>th</sup> (4 Mo), 150<sup>th</sup> (5 Mo) and 180<sup>th</sup> (6 Mo) age and marked as Group (Gr.)-I, Gr.-II, Gr.-III, Gr.-IV, Gr.-V, Gr.-VI and Gr.-VII respectively using standard protocol. All kids were fed with mother's milk up to weaning and were maintained under free range rearing system. Vaccination and deworming schedule followed in experimental animals were as per standard schedule. Each animal was turned out for natural grazing at 8.00 am to 12.30 pm and again at 2.30 pm to 5.30 pm. No extra concentrates feed was provided at the shelter.

### Blood sample collection

Blood samples were collected from jugular vein at 7.00 AM before any feed offered to the experimental animals. Whole blood was centrifuged (Remi, R8C centrifuge machine) at 3000 rpm for 30 minutes. Plasma was separated in the labelled sterile storage vials and kept frozen at  $-20^{\circ}\text{C}$  till further analysis. The growth hormone was estimated using the goat specific commercially available Growth hormone HGH ELISA kit [5]. The estimation of cortisol was done using goat specific Cortisol Elisa Kit [6]. The experimental data were subjected to appropriate statistical analysis by using the method [7] using the software IBM-SPSS (version 20.0).

## Results and Discussion

The mean with standard error of hormonal parameters viz. Growth hormone (ng/ml) and Cortisol (ng/ml) of black Bengal kid during summer and winter season have been presented in [Table-1]. The seasonal variation was noticed in cortisol level ( $P \leq 0.01$ ). Cortisol was significantly ( $P \leq 0.01$ ) more in the kid born in summer ( $40.76 \pm 2.14$  ng/ml) than winter ( $35.48 \pm 1.91$  ng/ml). The value of GH in present study ( $0.41 \pm 0.01$  ng/ml) was lower than values reported in Shiba goat [8,9], Honamli and native hair goats [10,11], Tellicherry goats [12] and cross bred

Table-1 Mean with standard error of hormonal parameters during summer and winter season of black Bengal goats during Pre pubertal growth

Parameters	Sex	G1	G2	G3	G4	G5	G6	G7	Overall	P Value
Growth Hormone(ng/ml)	Summer	0.39±0.04	0.40±0.03	0.42±0.03	0.42±0.03	0.42±0.03	0.42±0.03	0.44±0.02	0.42±0.1	0.53 (Between Summer and Winter)
	Winter	0.40±0.03	0.41±0.03	0.41±0.03	0.42±0.03	0.40±0.02	0.44±0.03	0.42±0.03	0.41±0.01	
Cortisol (ng/ml)	Summer	51.37±5.4	38.03±5.32	28.48±4.36	34.88±4.61	48.02±4.40	41.32±7.54	43.24±5.92	40.76±2.14	0.01** (Between Summer and Winter)
	Winter	32.00±2.92	39.33±5.41	41.27±5.54	29.55±4.58	34.46±5.26	32.67±5.76	39.09±5.67	35.48±1.91	

Means having different superscript in the last column (x, y) for the specific parameter differ significantly between season, \*\*  $P \leq 0.01$ , \*  $P \leq 0.05$

goats [13]. The lower GH levels in black Bengal Kids may be one of the causes of stunted growth in this breed of goats. Season had no influence on GH secretion. The value of cortisol in goat kids was in accordance with the earlier reports of [14] in kids. The cortisol values were nearer to the reports of [15,16]. In this present study, cortisol level was higher in kids born in summer than winter. The cortisol is considered to be a good stress marker in goats [17]. The altered cortisol levels during summer season is due to heat stress [18,19]. Cortisol works as vasodilators to facilitate heat loss and have stimulatory effects on proteolysis and lipolysis, hence, providing energy to the animal to help to offset the reduction of heat intake [20].

#### Relationship between body weight gain features and hormonal parameters

Growth hormone was positively correlated ( $P \leq 0.01$ ) with height (0.267), heart girth (0.311) and linear length (0.321) and cortisol was positively correlated ( $P \leq 0.01$ ) with only linear length (0.237) irrespective of season. It was also noticed that body weight had no correlation with any of the hormones. The growth hormone and cortisol were positively correlated ( $P \leq 0.01$ ) between themselves (0.542).

Body weight had no correlation with any of the hormones. Growth hormone was positively correlated ( $P \leq 0.01$ ) with height, heart girth and linear length. The concept of the relationship of GH and growth is gradually changing as evidence accumulates that GH has a far greater function than just growth stimulation, it is quite evident that we must abandon the hypothesis that growth rate is directly proportional to the growth hormone secreted [21]. Concentration of plasma cortisol is a useful indicator of stress and muscle damage in goats [22]. Cortisol had no relation with body weight indicating minimum stress and muscle damage in the growing kids [23,24].

#### Conclusion

The mean concentration of growth hormone was found to be  $0.41 \pm 0.01$  ng/ml indicating probable cause of stunted growth in highly prolific black Bengal goat breed. Cortisol level during summer season was higher than the earlier reports signifying more stress due to climatic condition. Hence, it can be concluded that proper breeding and management practices must be followed for reducing climatic stress during growth period.

**Application of Research:** Study of seasonal changes in plasma Growth hormone and Cortisol hormone during prepubertal growth period in black Bengal goat kids.

**Research Category:** Veterinary Physiology

**Abbreviations:** IVRI- Indian Veterinary Research Institute, ERS- Eastern Region Station ICAR- Indian Council of Agricultural Research, ELISA Test- Enzyme-linked Immuno Sorbent Assay Test, WBUAFS- West Bengal University of Animal & Fishery Sciences.

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**Author Statement:** All authors read, reviewed, agreed and approved the final manuscript. Note- All authors agreed that- Written informed consent was obtained from all participants prior to publish / enrolment

**Study Area/ Sample Collection:** ICAR-IVRI, ERS at Kalyani Goat Farm of Nadia district, West Bengal.

**Breed Name:** Black Bengal Goats

**Conflict of interest:** None Declared

**Ethical Approval:** Ethical approval taken from Institutional Animal Ethics Committee and Department of Veterinary Physiology, West Bengal University of Animal and Fishery Sciences, Belgachia, Kolkata, 700037, West Bengal, India  
Ethical Committee Approval Number: Nil

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